

## **DENTAL IMPLANT WITH AN INTEGRAL STRUCTURE COMPLETELY OR PARTIALLY REALIZED IN ADVANCE**

### **BACKGROUND OF THE INVENTION**

The present invention concerns a dental implant complete with a stump realized in two variants. The first variant concerns a dental implant realized in advance. The second variant concerns a hollow dental implant partially realized in advance. Both the variants makes the dental implant suitable for being completely personalized and applied in one single surgical visit without further surgical re-entry. Said stump realized in advance is joined to the body of the implant which is inserted into the bone. Such part of the implant is usually called "fixture" and it may be filed immediately after the surgical operation already in the mouth of the patient. In particular, it may be filed immediately in the full variant and after the reconstruction of the intra-oral stump in the hollow variant. For what concerns the art known up to now, the implants are prosthesis out of titanium inserted into the bone for replacing or imitating the functions of the missing root of natural teeth. Onto said implants, a prosthesis crown is built in a prosthetic process. Essential condition for performing the implantology is the presence of bone sufficient for their integration with said bone itself.

### **BRIEF SUMMARY OF THE INVENTION**

It is the aim of the present invention to realize an implant consisting of one single piece, both in the full variant and in the hollow variant. Both the variants containing inside the fixture (that is to be inserted in the bone and that may be similar, in its outer side, to a screw fixture), and the stump, joined each other by the maker.

According to the present invention, a stump may be obtained to be suitable for the correct insertion of a prosthesis. In fact, the shape of a truncated cone called "abutment" of the stump inserted into said fixture in the full variant allows to shape, directly in the mouth and with the help of a preparation cutter mounted onto a turbine, a stump having the correct inclination for the correct prosthesis habilitation.

Furthermore, the funnel-shaped shell of the trans-mucous part of the stump, in the hollow variant, allows the dentist to personalize the stump, which can be realized with a pin,

preferably of zirconium fibre, and with a polymerized compound safe from fluids. Due to just said funnel shape which insulates the stump and the pin from the mucous membrane, it is possible to obtain a stump with the desired inclination in the desired moment.

In the hollow variant, the implant may be partially covered for the time desired, just surfacing from the mucous membrane and thus behaving like a trans-mucous implant.

Furthermore, once the stump is filed, the stump can be shaped so that the axis of the stump be coinciding or angled with respect to the one of the fixture, according to the needs. Therefore, it will be easy, in the presence of a good primary stability, to construct and cement in the same visit a provisional tooth or a definitive crown.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Two variants of a single-phase dental plant with a single structure comprising a stump completely or partially realized in advance, according to the present invention, will be shown herein below relating to the enclosed drawings.

Figure 1 shows a single-phase dental plant with a single structure comprising a stump completely or partially realized in advance, according to the present invention, with the stump already realized in the full or VP variant;

Figure 2 shows a perspective view of the dental plant of figure 1;

Figures 3, 4, 5 and 6 show a frontal view of the dental plant of figure 1 according to different operating steps;

Figure 7 shows a perspective view of a detail of the dental plant shown in figure 2;

Figure 8 shows a cross-sectional view of the dental plant shown in figure 1;

Figures 9, 11 and 13 show a cross sectional view of a single-phase dental plant with a single structure comprising a stump completely or partially realized in advance, according to the present invention, in the hollow or VC variant, so as to be personalized, and shows the fixture that must be inserted into the bone;

Figures 10, 12 and 14 show a plan view of a portion of the dental plant shown in figures 9, 11 and 13;

Figures from 15 to 26 show a perspective view of the dental plant shown in figures 9, 11 and 13 according to different operating steps.

## DETAILED DESCRIPTION OF THE INVENTION

Figure 4 and 5 show a full variant VP of the implant according to the invention.

In particular, figure 4 and 5 show a stump D which is obtained for allowing the correct insertion of the prosthesis in a bone tissue. The truncated cone shape of the abutment of the full variant VP allows to model the stump D from the original shape to a shape having the correct inclination for the prosthesis rehabilitation. As shown in figure 4, the modeling step of stump is achieved by a preparation cutter mounted onto a turbine M, directly in the patient's mouth.

The shell in the shape of a funnel of the stump D (figure 9) allows the dentist to personalize the stump D. In particular, according to such an embodiment, the dentist can realize the stump D with a pin G, preferably of zirconium fibre and a compound H (figures 11-14) so as to obtain a stump D with the preferred inclination (figure 16).

As shown in figures 18 and 19, a hollow variant VC of the implant, according to the invention, may be partially covered by surfacing from the mucosa, as like a trans-mucous plant. After filling the stump D, the stump D may be obtained for presenting an axis coinciding with the one of the fixture A (figures 17 and 19), or angled with respect to the axis of the fixture A (figures 18, 20 and 21).

According to the full variant VP, shown in figures 1 and 2, the fixture A must have a cylindrical or conical shape to be inserted into the hole performed by the odontologist in the bone of the patient by means of special cutters.

The implant is screwed into the patient's bone until the passage area I located between the titanium and zirconium parts. In particular, the passage area I is located between the neck C of the implant and the stump D. Such passage area I arrives to the limit of the bony crest I' when the implant is screwed into the patient's bone.

The turns B of the fixture A are industrially treated to have a rough surface for improving the bone integration. The turns B end in the area of the implant's neck C which is smooth, cylindrical and can be variable in length.

The stump D comprises two parts. The first part D', shown in figures 1, 2, 8 and called "transmucous", may be cylindrical or in the shape of a truncated-cone. The second part D'', shown in figures 1, 2 and 8, may be in the shape of a truncated-cone. If the first part D' is cylindrical, the first part D' has the same diameter of the fixture A in the area of the neck C. If the first part D' has a shape of a truncated-cone, the second part D'' has a conicity more

marked than the first one. Both parts D', D'' of the stump D, may be realized in such a way that the passage from the first part D' to the second part D'' is not distinct but gradual. In particular both parts D', D'' can be shaped with concave or convex walls. The second part D'' may also have the shape of a hemisphere. The first part D' (figure 1) can be made with different heights.

According to other embodiments, the first part D' and the second part D'' may be realized for better simulating the shape of the incisor teeth. In particular, the first part D' can be made with an elliptic section and the second part D'' (figure 3) can be made with a bio-compatible, like zirconium, with different colours so that to better simulate the natural tooth even in the first "transmucous" part D', mainly after a possible mucous recession.

However, a structure D''' is provided at the centre of the wider base of the truncated-cone. The structure D''' has a cubic shape (figures 1, 2, 7 and 8). Said structure D''' constitutes a holding structure.

As shown in figure 7, a small key P may be used for screwing the implant in the patient's bone.

In other words, the structure D''' can be considered like a Mounth. However, the Mounth may be removed by unscrewing it, while the structure D''' may be easily filed at the end of the visit.

Similarly, also a slot performed in correspondence of the end of the second part D'' of the stump D may have the same function. Indeed, a screwdriver may be inserted in the slot for screwing the implant.

1A stump D, in the shape of a truncated cone, allows to insert the plant in the preferred position which is determined by the particular functional needs and by the inclination of the bony crest I'. In particular, the truncated-cone shape allows to obtain a stump D with an axis parallel to the one of the teeth nearby, after having achieved a grinding processing step by means of the cutter mounted onto a turbine M (figure 4) or directly in the mouth of the patient. More in particular, it has to be considered that it is possible to obtain a stump D with an inclination of the axis suitable for realizing a correct prosthesis, notwithstanding the portion of the implant inside the bone, extends along an axis with a different inclination (figure 5).

According to such an embodiment, it is not necessary to chose the correct stump D to be inserted in the bone. By the contrary, it is sufficient to obtain from the stump D realized in advance, the desired shape by cutting the preformed stump D directly in the mouth, in the same way as natural teeth are filed.

## CLEAN COPY – REPLACEMENT SHEETS

Therefore the implants may be personalized so that the implants can be more similar to the natural teeth.

The stump D may be lengthened and modified by adding some compound after having cut a small hole, with a truncated-cone diamanded cutter mounted onto a turbine. In this way, it is possible to assure a primary retention by completely using zirconium material or compound material which another compound material is added to be polished by preparation cutters.

If compound crowns are used, cemented with the same kind of compound, an over-gingival Chanfer preparation may be performed. Such a prosthesis is very realistic, having a natural aspect even with trans-illumination, because there is no metal in the stump D. In this way, also the problems due to the presence of more than one metal are solved.

If there is a good primary retention and a good quality bone, the stump D may be filed to achieve an imprint of the provisional prosthesis made by resin or the definitive prosthesis CP (figure 6), during the same visit of the surgical insertion.

In the case of a compound prosthesis, this latter may be realized directly after having taken the imprint, so that the compound prosthesis may be definitely cemented, finished and polished directly in the mouth of the patient.

it is not necessary to provide a hollow fixture A for fixing the stump D or the cementable pin G for housing the passing through screw. Accordingly, the implant do not contain hollow spaces which can form cracks, unless such housing is not projected on purpose for making the structure lighter. Otherwise such potential housings can be preferably filled with light inert material.

From the outside, the fixture A can be made of titanium for simulating, if necessary, the structure of a implant already existing, but inside the hollow area Z (figure 8), it can be obtained with a suitable shape and length as to allow the connection and the primary retention with the zirconium or compound stump D. In such a case, the groove must be realized according to correct sizes, so as to assure, at the same time, the correct resistance of the titanium walls of the fixture A. For example, the shape of the groove may be of an upside-down truncated cone with a small conicity, with the lower base turned towards the oral cavity and the occlusion plane.

Furthermore, the part working as a stump D may be realized of titanium only or have a reinforcing titanium core.

The fixture A may have a cylindrical and/or conical shape and/or the shape most suitable for obtaining the best functional result.

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The second variant (figures 9, 11 and 13) of the mono-phasic mono-block implant of the hollow kind VC consists of an implant formed by a fixture A and by a stump D of zirconium, or compound, or other aesthetic and/or transparent material, externally similar to the one above described, but hollow inside, like a funnel.

Such an embodiment, allows to insert a transparent pin G (figures 18, 19 and 20) inside the stump D. For example, the pin G can be made of zirconium fibre cemented with a photo-polimerizable compound.

Thus, a mono-block constituted by a compound and a pin of fibre is formed between the walls of the implant. The compound and the pin project over the edges of the funnel-shaped walls shown in figures 18, 19 and 20, so that they lie inside the mucosa and project from the part X opposite the fixture A (figures 15, 16 and 17). In this way, the stump D can be realized by the dentist in the mouth of the patient like the stump of a natural filed tooth. In particular, the stump D is suitable for that situation of angulation between the crown and the axis of the plant and the inter-dental distance. In this way, the implants may be personalized.

Accordingly, the implant must be inserted so that the funnel-shaped stump D projects from the mucosa. The part of the fixture A to be inserted is inserted into the bone up to the collar W (figures 15, 16 and 17) which establishes a passage area between titanium and baked clay in the outer part. The titanium fixture A and the baked clay are mechanically linked, as shown in figures 9, 11 and 13. In particular, the mechanical link is constituted by a receiving portion, like a hollow area, shaped inside the titanium of the fixture A. The substance constituting the stump D covers said groove or hollow area according to a thickness (e.g. one millimeter) suitable for making the structure and the fixture A resistant.

The walls of the groove may be parallel or slightly diverging as in H' of figures 9, 11 and 13. In this way the walls of the groove assure a greater mechanic retention of the material forming the funnel-shaped stump D. Said structure may also have holes, or notches, or other cuts, in the walls, as well as in the bottom, for increasing the retention of the baked clay or, the compound, or any other material forming the titanium stump D or fixture A. The length of the groove into which the material for forming the funnel of the stump D is inserted, must be suitable for the retention and solidity of said material, e.g. 4 millimetres, and must be determined together with the maker.

The internal surfaces of the hollow may be preferably continuous without any distinct passage between them (figure 9). Such solution allows an easy insertion of the key of titanium or steel or any other suitable material, inside the hollow for screwing the implant

into the bone. The key, which works as the male element, must be inserted into the hollow, which works as the female element. The key may have the shape of a parallelepiped Y (figure 22) with a square base, or a shape similar to the one of the hollow into which it has to be inserted. The key presents dimensions slightly smaller than the hollow so as to allow an easy insertion and removing, still in consideration of a retention suitable for the screwing of a implant. The key consists of a stem and of a head T. The stem has the function of engaging the hollow of the fixture A for screwing the same into the bone and it may have the shape of a parallelepiped. The stem may be pyramid truncated-cone shaped and also suits better for the morphology of the fixture A.

According to the present invention, at the opposite side of the stem, the head T of the key Y is greater than the stem itself and, for example, cubic and cylindrical shaped. In this way, the key Y allows the insertion of a ratchet which aids the screwing manual operations, provided with a support for the counter edge of the implant. The dimensions of the key Y may be different. The stem may have various length so as to favour the insertion of the implant in areas difficult to reach. The thickness of the stem and radius of the head T may vary.

The variant of the hollow implant is useful in the cases of the non alignment between the axis of the fixture A and the axis of the crown. The funnel-shaped stump D allows the dentist to polymerize, by the use of a lamp W' (figure 23) or with a self polymerizing compound, the compound inside it so that to form a monoblock of zirconium or, compound or, other suitable material, between the outer part of the stump D and the metal of the fixture A.

In order to make the stump D immediately, the outer part of the funnel-stump D of the implant to contact the lesioned, bleeding and exuding, tissues by the operation, for protecting the polymerization occurring inside from the fluids however present.

Once the compound is solid and adapted to the mouth of the patient so as to form a stump D of correct dimensions, it is easy to file the sump D to prepare it for the print for realizing the crown of a compound or integral baked clay.

The result presents a high aesthetic value.

If the fixture A is secure, the whole operation may be performed in a few hours and the patient is able to make use of the implant in a short time. If the dentist is a skilled one, he may realize the crown CP (figure 24) of compound, also directly in the mouth of the patient.

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According to the invention, the choice of the colour and the correct disposition of the layers of the masses are easier than before. If the fixture A is not secure, it is necessary wait for integration of the bone, using the funnel as a recovering screw or as a trans-mucous implant.

The edges of the funnel can be filed with a cutter mounted onto a turbine TB (figure 17) which rounds such edges for fitting them to the gingival tissues without cutting or troublesome. The concave part of the funnel is sealed with provisory filling material PR (figures 15 and 16) to proceed, in the right moment, to form the stump D, projecting from the gingiva for the corresponding crown.

This is the primary indication for the use of the hollow variant because if there is no primary retention, the implant may be inserted without destabilizing itself also even if noxious intra-oral forces, like chewing or bruxing, act on the same. On the contrary, the implant is protected inside the bone and the gingiva, surfacing from the same, so as to postpone the bone integration, the reconstruction phase of the stump D and of the crown CP.

In order to better fitting to the anatomy of the natural teeth, the funnel shaped stump D may have different shapes: the section perpendicular to its long axis may be round for canines, premolar, the lower incisors and the molars; elliptical, (figure 25), for the upper incisors, or even of the most suitable shape for simulating the roots of the molar teeth (figure 26). This may be done because the part to be inserted into the bone, i.e. the fixture A, is always maintained in a cylindrical or conic shape being always screwable, while the trans-mucous funnel shaped part may assume different shapes, as similar as possible to the anatomy of natural teeth, because the soft tissues oppose no resistance and impediment to the circular screwing motion necessary for the insertion thereof. The same operation may be performed in the full variant VP, with the stump D. A further element of the implant according to the present invention, consists of a fibre pin G, e. g. out of zirconium, bent or angled as shown in figure 21, for keeping the core H of the compound shown and forming the stump projecting into the oral cavity.